Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
Central Regional Office • 627 Main Street, Worcester MA 01608 • 508-792-7650

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April 18, 2012

Rohm and Haas Electronic Materials, LLC
455 Forest Street
Marlborough, MA 01752

Attn: Stephen J. Kmiotek

Re: **APPROVAL** LPA Tr #X233345- chemical vapor deposition (CVD) Reactor and air pollution control equipment
FMF No. 130595 FMF
Classification: SM80-7
SSEIS No. 1190910

Dear Mr. Kmiotek:

The Massachusetts Department of Environmental Protection, Bureau of Waste Prevention, Permitting Section ("MassDEP") has determined that the referenced Limited Plan Application ("LPA") is administratively complete and in conformance with current air pollution control engineering practices. MassDEP approves the referenced LPA authorizing the proposed construction, substantial reconstruction and/or alteration, and subsequent operation, of the silicon carbide reactor and the (2) scrubbers at the referenced location.

This LPA Approval is in accordance with 310 CMR 7.02 of the Air Pollution Control Regulations ("Regulations"), 310 CMR 7.00, as adopted pursuant to M.G.L. c.111, sections 142A-1420.

Included as part of the LPA Approval are the following:

- Stamped approved **BWP AQ 01-B** Application form,
- BWP SFC-3-supplemental form for wet collection equipment,
- Special Conditions,
- General Conditions for Non-Fuel Emission LPAs,

Please review the entire LPA Approval carefully as it stipulates the particular conditions which the facility owner/operator must adhere to for the facility to be constructed/reconstructed/altered and operated in compliance with the Regulations.

MassDEP has determined that the filing of an Environmental Notification Form ("ENF") with the Secretary of Environmental Affairs, for air quality purposes, was not required prior to this action by MassDEP. Notwithstanding this determination, the Massachusetts Environmental Policy Act and Regulation 301 CMR 11.00, section 11.04, provide certain "Fail-Safe Provisions" which allow the Secretary to require the filing of an ENF and/or Environmental Impact Report later.

I. FACILITY DESCRIPTION

Rohm and Haas Electronic Materials, LLC ("Rohm and Haas") manufactures specialty chemicals for the semiconductor and electronics industries. The Marlborough facility conducts Display Technology (DT) and Optical and Ceramics Technology (OCT) manufacturing and research.

II. PROJECT DESCRIPTION

This approval is for the installation and operation of a low pressure chemical vapor deposition (CVD) reactor to manufacture and deposit silicon carbide (SiC) on a substrate. The CVD reactor uses methyltrichlorosilane (MTS) as the main reactant to produce a layer of silicon carbide on a graphite substrate. MTS vapors are condensed onto the graphite substrate at high temperatures and under a vacuum. MTS is delivered to the site in 120-gallon portable carbon steel tanks. The MTS is transferred (using argon or nitrogen) to 60- gallon processing bubblers used to vaporize the MTS. Hydrogen gas is used in the reactor to maintain a reducing atmosphere. The site will store less than 5,000 pounds of MTS and less than 35,000 cubic feet of compressed hydrogen (at 2200 psig). Gases are injected into the top of the water cooled reactor. After the graphite substrate is placed into the reactor the furnace is electrically heated to between 1200 – 1500 ^{0} C and then MTS, carrier gases and hydrogen are introduced. Silicon carbide (SiC) forms on the exposed graphite surfaces as the MTS decomposes at a rate of about 8 pounds per hour. The process continues typically from 30 to 220 hours.

The reactor will consume no greater than 197,000 pounds of MTS per 12 month rolling period based on a MTS conversion rate of 80%. Reactor exhaust gases are comprised of argon, nitrogen, hydrogen, unreacted MTS, and hydrogen chloride gas (HCL). The un-reacted MTS and HCL gases are cooled to approximately 35 ^{0} C and exhausted through vacuum pumps to two (2) water scrubbers at 22 scfm each. Each scrubber contains baffles and spray nozzles and will treat half the reactor exhaust flow. Each scrubber shall spray 4 gallons per minute (GPM) of city water mixed with a sodium hydroxide caustic mixture. The scrubbers are rated at 99.99% HCL control efficiency.

Based on a site visit on September 7, 2011 by Department personnel, and pursuant to your letter dated July 18, 2011, the stack testing requirements have been revised. **This revised LPA approval supersedes in its entirety the original approval dated September 8, 2010.**

III. SPECIAL CONDITIONS

1. MTS usage shall not exceed 197,000 pounds per 12 month rolling period.

2. The Hydrogen Chloride gas emissions after control shall not exceed .0027 pounds per hour and 15 pounds per year during a twelve month rolling period.

3. The reactor shall not operate unless the scrubber is operating.

4. The exhaust stack shall be comprised of polyvinyl chloride (PVC), have a 4 inch (4") exit diameter, and at least 10 feet above the roof level.

5. Both scrubbers shall have automatic controls to assure proper functioning and alarms to signal upset conditions to the operators. Each scrubber shall be equipped with a water flow meter, low and high water level alarm, differential pressure manometer across each scrubber.

6. The standard operating and maintenance procedures (SOMP) for the scrubbers shall be posted in close

proximity to the scrubbers.

7. The CVD reactor and the MTS vaporizer shall be interlocked with the scrubber so that the scrubber will be properly operating before MTS can be introduced to the reactor.

8. Rohm and Haas shall monitor and maintain MTS usage on a monthly and rolling 12 month period basis.

9. Sodium hydroxide tank levels shall be monitored and recorded at least daily. Records shall be dated and initialed daily.

10. Within 30 days after the start-up of the reactor and scrubbers, Rohm and Haas shall submit a stack testing protocol for emission testing at the scrubber exhausts to determine the emission of hydrogen chloride to the ambient air.

11. Within 60 days after MassDEPs approval of the testing protocol, Rohm and Haas shall conduct stack testing at the scrubber exhausts to determine the emission of hydrogen chloride.

12. Within 60 days of the emission testing of the scrubbers, submit a report of the stack testing that quantifies the emissions of hydrogen chloride. Additionally, the test report shall include calculations of the conversion rate of MTS to silicon carbide based on mass balance.

IV. GENERAL CONDITIONS FOR NON-FUEL EMISSION LPAs

A. INSTALLATION and OPERATION - No person shall install or operate the equipment as noted in this plan application except in conformance with the requirements established in this Approval. This approval is only for the equipment as noted within the application or as may otherwise be specified in the plan approval letter.

B. SUSPENSION, MODIFICATION, AMENDMENT OR REVOCATION – This approval may be suspended, modified, amended or revoked by MassDEP if, at any time, MassDEP determines that the facility is violating any condition or part of this approval. This approval may be modified or amended when in the opinion of MassDEP a modification or amendment is necessary or appropriate to clarify the approval conditions or after consideration of a written request by the Permittee to amend the approval conditions. Any relaxation of an emission limit or a specific condition noted in this approval that would result in an increase in emission rates as established in this approval must be made in accordance with 310 CMR 7.02..

C. OTHER REGULATIONS - This approval does not negate the responsibility of the owner/operator to comply with this or any other applicable federal, state, or local regulations now or in the future. Nor does this approval imply compliance with any other applicable federal, state or local regulation now or in the future.

D. EXISTING APPROVALS - All plan approvals under 310 CMR 7.02 issued prior to the effective date of this approval shall continue to be in effect unless specifically changed by this approval letter. The facility shall meet the emission rates and approved conditions specified in the applicable plan approval(s) unless specifically altered by this approval.

E. VISIBLE EMISSIONS - Unless otherwise required by this plan approval, opacity, exclusive of uncombined water, shall not exceed 0% at all times during all modes of operation, including startups and shutdowns. Visible emissions or opacity that exceed the limits set forth in this approval shall be reported to MassDEP in writing or by fax within seven (7) days of the occurrence.

F. DUST AND ODOR - The facility shall be operated in a manner to prevent the occurrence of dust or odor conditions that may cause or contribute to a condition of air pollution as defined in Regulation 310 CMR 7.01 and 7.09.

G. NOISE - Noise from the facility during routine operation, including startups and shutdowns, shall not exceed MassDEP noise guidelines and shall not cause a condition of air pollution as defined in Regulation 310 CMR 7.01 and 7.10.

H. ASBESTOS - Should asbestos remediation/removal be required as a result of this approval, such asbestos remediation/removal shall be done in accordance with Regulation 310 CMR 7.15.

I. TESTING –

1) Any emission testing conducted to show compliance with the limitations in this approval must be conducted in accordance with the Environmental Protection Agency test methods as specified in the Code of Federal Regulations, Title 40, Part 60, Appendix A - Standards of Performance for New Stationary Sources or by another method correlated to the above method to the satisfaction of MassDEP and in accordance with the requirements noted in 310 CMR 7.13.

2) In accordance with 310 CMR 7.13, MassDEP may require testing for any pollutants if deemed necessary to ascertain the emission rates and relationship to equipment design and operation. When informed in writing by MassDEP that stack testing is necessary to ascertain compliance with the Air Pollution Control Regulations or design approval provisions the Permittee shall conduct the required stack testing. Such stack testing shall be:

a) Conducted by a person knowledgeable in stack testing, and
b) Conducted in accordance with procedures contained in a test protocol which has been approved by MassDEP, and
c) In the presence of a representative of MassDEP when such is deemed necessary in accordance with 310 CMR 7.13.

J. RECORD KEEPING –

1) A record keeping system shall be established and continued on site by the Permittee. All records shall be maintained up-to-date such that twelve-month rolling period information is readily available for Department examination. Record keeping shall include, at a minimum:

a) The initiation and completion dates for the proposed construction, reconstruction or alteration.
b) Compliance records sufficient to demonstrate that emissions of air contaminates have not exceeded what is allowed by this approval. Such records may include daily production records, raw material usage rates, fuel purchase receipts, emissions test results, monitoring equipment data and reports.
c) Maintenance: A record of routine maintenance activities performed on emission unit, control equipment and monitoring equipment including, at a minimum, the type or a description of the maintenance performed and the date and time the work was completed.
d) Malfunctions: A record of all malfunctions on emission unit, control equipment and monitoring equipment including, at a minimum: the date and time the malfunction occurred; a description of the malfunction and the corrective action taken; the date and time corrective actions were initiated; and the date and time corrective actions were completed and the emission unit returned to compliance.

2) All records shall be kept on site for five (5) years and shall be made available to MassDEP upon request.

3) Pursuant to the authority granted to MassDEP at 310 CMR 7.02, the facility shall maintain a copy of this approval, and any subsequent modifications of this approval, on-site for as long as the approval is valid. The approval is valid until one of the following conditions occur: the equipment is dismantled or removed from the facility, the facility notifies MassDEP that the approval is no longer valid, the equipment is substantially reconstructed or altered and subject to 310 CMR 7.02, the approval is superceded by another approval, or MassDEP revokes the approval in accordance with 310 CMR 7.02. MassDEP may revoke, in accordance with 310 CMR 7.02, any plan approval if the actual construction has not begun within two years from the date of issuance or if, during the construction, the construction is suspended for the period of one year or more.

K. REPORTING –

1) In accordance with 310 CMR 7.12, the facility shall register on a form obtained from MassDEP such information as MassDEP may specify including:

a) A description of the facility, including a description of process and combustion equipment, a description of facility operating hours and operating schedule, a description of all raw materials and fuels used at the facility.
b) Detailed emissions estimates for all criteria and hazardous air pollutants emitted from the facility.
c) An emission statement summarizing and certifying actual annual emissions and peak ozone season day emissions of VOC and oxides of nitrogen.
d) A description of air pollution control equipment, including control efficiencies.
e) Calculations and assumptions used to support emissions such as annual fuel process rate and peak ozone season daily process rate.
f) Information required by 310 CMR 7.12 shall be submitted pursuant to the reporting schedule identified in 310 CMR 7.12.

2) Any construction, substantial reconstruction or alteration, as described in 310 CMR 7.02, of equipment as noted within this plan approval application at this facility shall be reported in writing to MassDEP 30 days prior to said construction, substantial reconstruction or alteration and on the next required source registration.

3) The Regional Bureau of Waste Prevention, Compliance and Enforcement office, must be notified by telephone or fax as soon as possible (but no later than 24 hours) after the occurrence of any exceedance of an emission limit as noted within this plan approval OR any upsets or malfunctions to the facility equipment, air pollution control equipment, or monitoring equipment which result in an excess emission to the air, a violation of any conditions of this plan approval and/or a condition of air pollution.

L. REMOVAL OF AIR POLLUTION CONTROL EQUIPMENT - Notwithstanding 310 CMR 7.02, no person shall cause, suffer, allow, or permit the removal, alteration or shall otherwise render inoperative any air pollution control equipment or equipment used to monitor emissions which has been installed as a requirement of 310 CMR 7.00, other than for reasonable maintenance periods or unexpected and unavoidable failure of the equipment, provided that MassDEP has been notified of such failure, or in accordance with specific written approval of MassDEP.

M. MONITORING - Equipment or emission monitoring systems installed for the purpose of documenting compliance with this approval shall be installed, calibrated, maintained and operated by the Permittee in sufficient manner to ensure continuous and accurate operations at all times.

N. COMPLIANCE ASSURANCE FEE – Pursuant to 310 CMR 4.03, an annual fee, based on the Commonwealth's fiscal year, will be charged to your facility to cover the cost of compliance activities

performed by MassDEP, including registrations, report reviews, inspections, source registration reviews, etc. No fee shall be charged in the fiscal year that the permit is issued. If multiple air quality permits exist for a facility, the facility shall pay the single highest applicable fee. This fee does not include stack test fees.

V. APPEAL

This approval is an action of MassDEP. If you are aggrieved by this action, you may request an adjudicatory hearing. A request for a hearing must be made in writing and postmarked within twenty-one (21) days of the date of issuance of this Approval.

Under 310 CMR 1.01(6)(b), the request must state clearly and concisely the facts which are the grounds for the request, and the relief sought. Additionally, the request must state why the Approval is not consistent with applicable laws and regulations. The hearing request along with a valid check payable to Commonwealth of Massachusetts in the amount of one hundred dollars ($100.00) must be mailed to: Commonwealth of Massachusetts, MassDEP, Commonwealth Master Lock Box, P.O. Box 4062, Boston, MA 02241-3982. The request will be dismissed if the filing fee is not paid, unless the appellant is exempt or granted a waiver as described below.

The filing fee is not required if the appellant is a city or town (or municipal agency), county, or district of the Commonwealth of Massachusetts, or a municipal housing authority. MassDEP may waive the adjudicatory hearing filing fee for a person who shows that paying the fee will create an undue financial hardship. A person seeking a waiver must file, together with the hearing request as provided above, an affidavit setting forth the facts believed to support the claim of undue financial hardship.

Should you have any questions concerning this Approval, please contact Paul Dwiggins at (508) 767-2760.

Sincerely,

This final document copy is being provided to you electronically by the Department of Environmental Protection. A signed copy of this document is on file at the DEP office listed on the letterhead.

Roseanna E. Stanley
Acting Permit Chief,
Bureau of Waste Prevention

RES/PD

ecc: Yi Tian, DEP-Boston